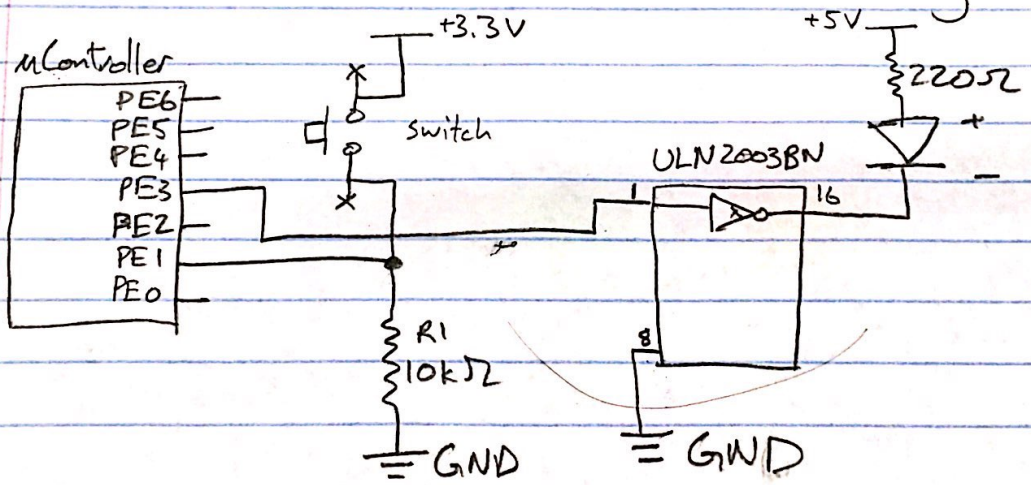
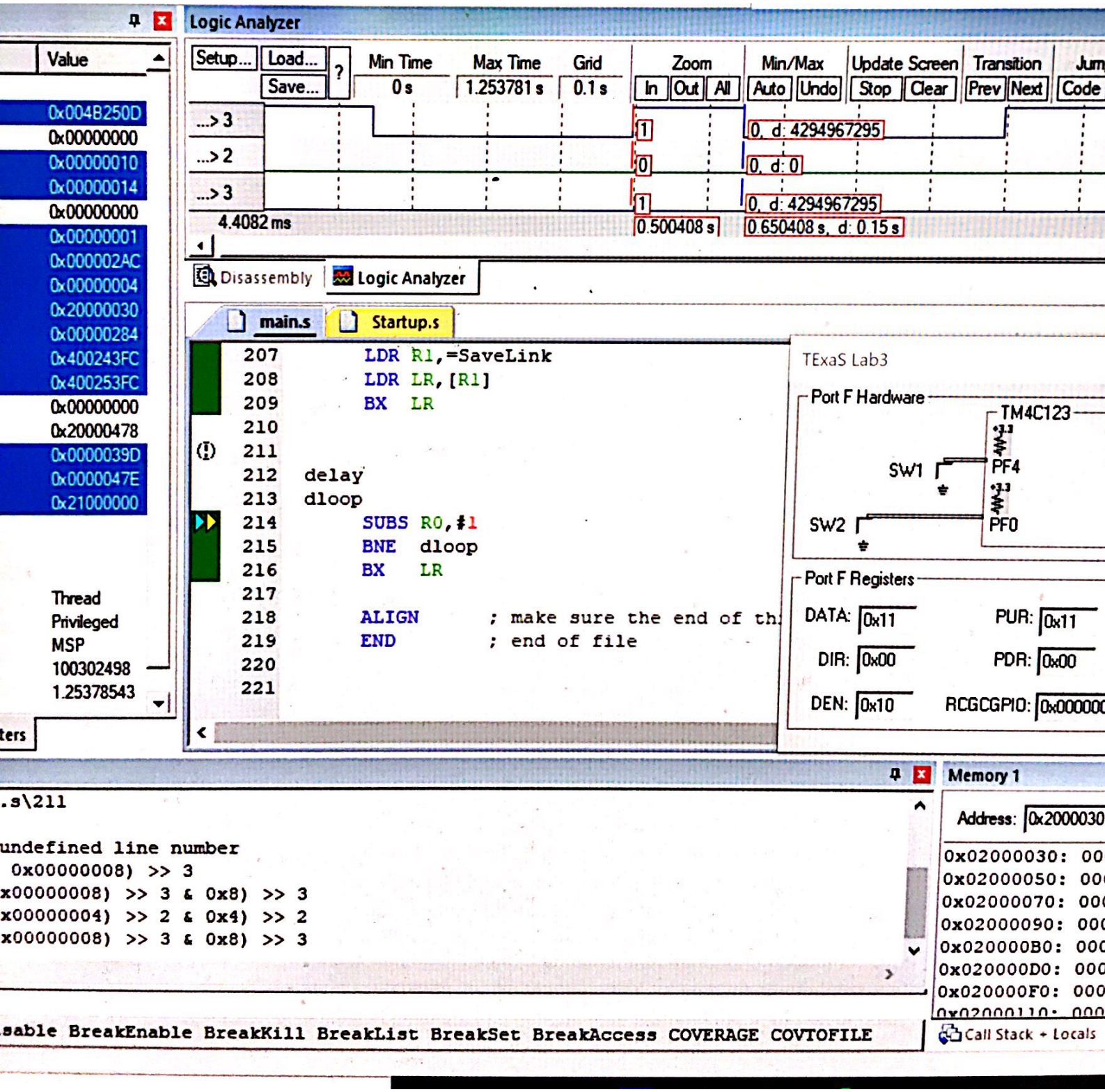
Lab 3 Table

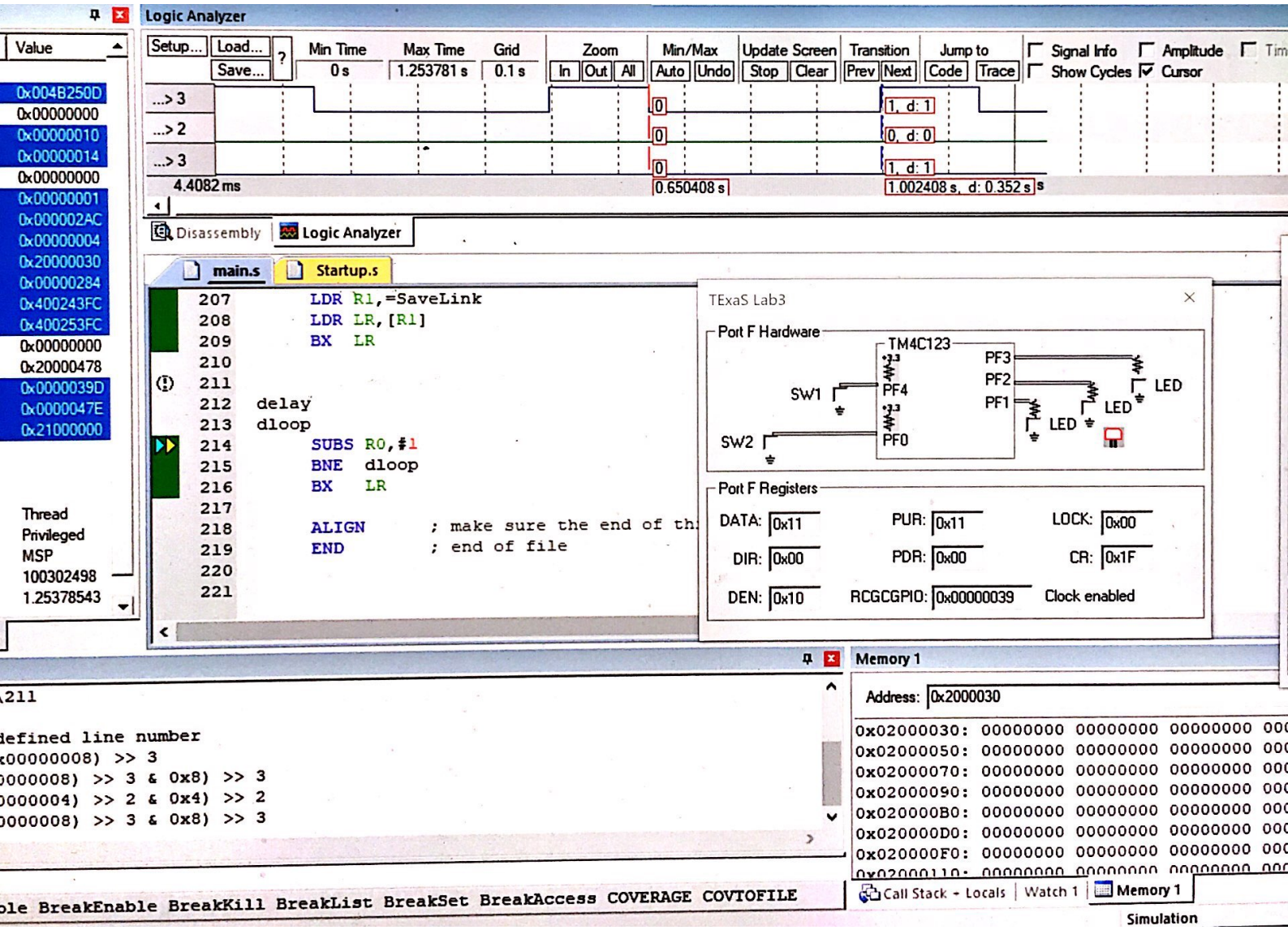
	Parameter	Value	Units
	Resistance of 10kΩ resistor	9850	Ω
	Supply Voltage $V_{+3.3}$	3.3	V
Switch not Pressed	Input Voltage V_{PE1}	0.0035	V
	Resistor Current	0	mA
Switch Pressed	Input Voltage V_{PE1}	3.3	V
	Resistor Current	0.33	mA

	Resistance of 220Ω	216 Ω
	5 V Power	5.14 V
Out = 0	V_{PE3} into ULN2003B	0 V
	ULN2003B Out, pin 16 V_k	3.6 V
	LED a^+, V_{a+}, anode	5.14 V
	LED Voltage	1.54 V
	LED Current (off)	0 mA calculated & measured
Out = 1	V_{PE3} into ULN2003B	3.229 V
	Pin 16 V_k	0.716 V
	LED anode V_{a+}	2.602 V
	LED voltage	1.886 V
	LED Current (on)	11.75 mA calculated 11.56 mA measured

Lab 3 Circuit Diagram







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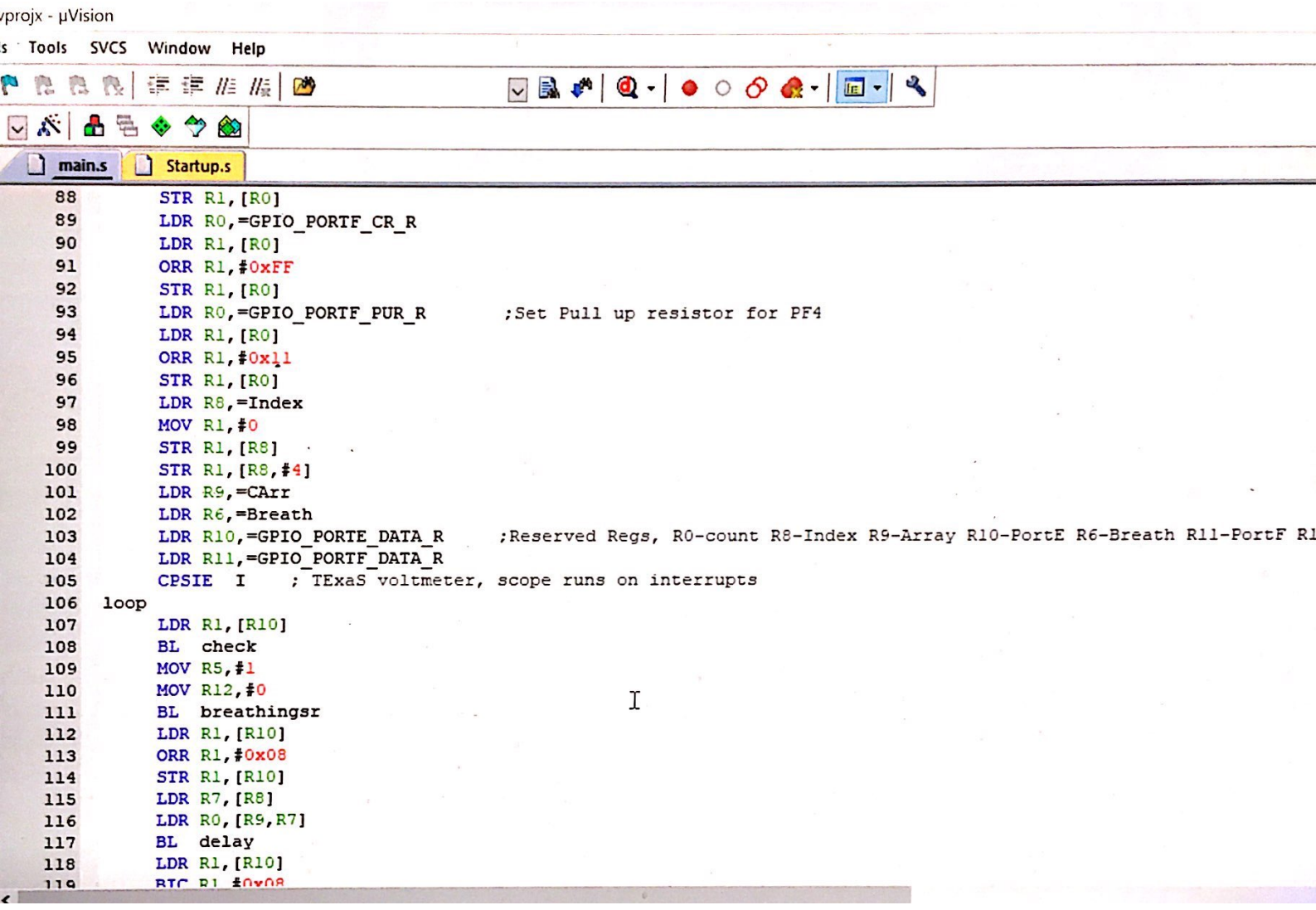
main.s Startup.s

```
28  ;       TIP: debugging the breathing LED algorithm using the real board.
29  ; PortE device registers
30  GPIO_PORTE_DATA_R  EQU 0x400243FC
31  GPIO_PORTE_DIR_R   EQU 0x40024400
32  GPIO_PORTE_AFSEL_R EQU 0x40024420
33  GPIO_PORTE_DEN_R   EQU 0x4002451C
34  ; PortF device registers
35  GPIO_PORTF_DATA_R  EQU 0x400253FC
36  GPIO_PORTF_DIR_R   EQU 0x40025400
37  GPIO_PORTF_AFSEL_R EQU 0x40025420
38  GPIO_PORTF_PUR_R   EQU 0x40025510
39  GPIO_PORTF_DEN_R   EQU 0x4002551C
40  GPIO_PORTF_LOCK_R  EQU 0x40025520
41  GPIO_PORTF_CR_R    EQU 0x40025524
42  GPIO_LOCK_KEY      EQU 0x4C4F434B  ; Unlocks the GPIO_CR register
43  SYSCTL_RCGCGPIO_R  EQU 0x400FE608
44
45
46          IMPORT  TExaS_Init
47          THUMB
48          AREA    DATA, ALIGN=2
49  ;global variables go here
50  Index   SPACE   4
51  Index2  SPACE   4
52  SaveLink SPACE  4
53          AREA    |.text|, CODE, READONLY, ALIGN=2
54          THUMB
55          EXPORT  Start
56  CArr    DCD     2000000, 4670000, 3300000, 3300000, 4670000, 2000000, 5950000, 660000, 660000, 5950000 ;3000000, 7000000,
57  Breath  DCD     15000/2, 135000/2, 45000/2, 105000/2, 75000/2, 75000/2, 105000/2, 45000/2, 135000/2, 15000/2
58  Start
59    ; TExaS_Init sets bus clock at 80 MHz
```

```
55          EXPORT  Start
56  CArr    DCD     2000000, 4670000, 3300000, 3300000, 4670000, 2000000, 5950000, 660000, 660000, 5950000 ;3000000,
57  Breath DCD      15000/2, 135000/2, 45000/2, 105000/2, 75000/2, 75000/2, 105000/2, 45000/2, 135000/2, 15000/2
58  Start
59   ; TExaS_Init sets bus clock at 80 MHz
60        BL  TExaS_Init ; voltmeter, scope on PD3
61        LDR R0,=SYSCTL_RCGCGPIO_R      ;turn on Port E and Port F clock
62        LDR R1,[R0]
63        ORR R1,#0x30
64        STR R1,[R0]
65        NOP
66        NOP
67        NOP
68        NOP
69        LDR R0,=GPIO_PORTE_DIR_R       ;Set PE1 as input, PE3 as output
70        LDR R1,[R0]
71        ORR R1,#0x08
72        BIC R1,#0x02
73        STR R1,[R0]
74        LDR R0,=GPIO_PORTF_DIR_R       ;Set PF4 as input
75        LDR R1,[R0]
76        BIC R1,#0x10
77        STR R1,[R0]
78        LDR R0,=GPIO_PORTE_DEN_R       ;Digitally enable PE1 and PE3
79        LDR R1,[R0]
80        ORR R1,#0x0A
81        STR R1,[R0]
82        LDR R0,=GPIO_PORTF_DEN_R       ;Digitally enable PF4
83        LDR R1,[R0]
84        ORR R1,#0x10
85        STR R1,[R0]
86        LDR R0,=GPIO_PORTE_LOCK_R
```



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main.s Startup.s

```
118         LDR R1,[R10]
119         BIC R1,#0x08
120         STR R1,[R10]
121         LDR R7,[R8]
122         ADD R7,#4
123         STR R7,[R8]
124         LDR R0,[R9,R7]
125         BL  delay
126         LDR R7,[R8]
127         SUB R7,#4
128         STR R7,[R8]
129         LDR R0,[R9,R7]
130         B    loop
131
132   check
133         AND R2,R1,#0x02
134         LSR R2,#1
135         CMP R2,#1
136         BNE skip
137         LDR R7,[R8]
138         CMP R7,#32
139         BEQ redo
140         ADD R7,#8
141         STR R7,[R8]
142         B   skip
143   redo
144         SUB R7,#32
145         STR R7,[R8]
146   skip
147         LDR R1,[R10]
148         AND R2,R1,#0x02
149         CMP R2,#0
```

```
145         STR R7,[R8]
146   skip
147         LDR R1,[R10]
148         AND R2,R1,#0x02
149         CMP R2,#0
150         BNE skip
151         BX  LR
152
153   breathingsr
154         LDR R1,=SaveLink
155         STR LR,[R1]
156   breathing
157         LDR R1,[R11]
158         AND R2,R1,#0x10
159         CMP R2,#0x10
160         BEQ done
161
162         MOV R2,#12
163   sameduty
164         LDR R1,[R10]
165         ORR R1,#0x08
166         STR R1,[R10]
167         LDR R7,[R8,#4]
168         LDR R0,[R6,R7]
169         BL  delay
170         LDR R1,[R10]
171         BIC R1,#0x08
172         STR R1,[R10]
173         LDR R7,[R8,#4]
174         ADD R7,#4
175         STR R7,[R8,#4]
176         LDR R0,[R6,R7]
```